

UNCLASSIFIED

AD NUMBER
AD457858
NEW LIMITATION CHANGE
TO Approved for public release, distribution unlimited
FROM Distribution authorized to U.S. Gov't. agencies only; Administrative and Operational Use; Feb 1965. Other requests shall be referred to the Army Biological Laboratory, Fort Detrick, MD 21702.
AUTHORITY
BDRL, per Dept/Army ltr dtd, 28 Sept 1971

THIS PAGE IS UNCLASSIFIED

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

4 5 7 8 5 8

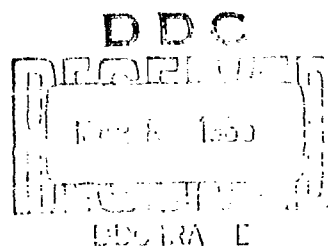
CATALOGED BY

AS AD NO. 457858

# TECHNICAL MANUSCRIPT 201

## MINIMUM DEW PERIOD AND TEMPERATURE REQUIRED FOR INFECTION BY PIRICULARIA ORYZAE

FEBRUARY 1965



UNITED STATES ARMY  
BIOLOGICAL LABORATORIES  
FORT DETRICK

U.S. ARMY BIOLOGICAL LABORATORIES  
Fort Detrick, Frederick, Maryland

TECHNICAL MANUSCRIPT 201

MINIMUM DEW PERIOD AND TEMPERATURE  
REQUIRED FOR INFECTION BY PIRICULARIA ORYZAE

Thomas H. Barksdale

Marian W. Jones

Crops Division  
DIRECTORATE OF BIOLOGICAL RESEARCH  
and  
Biomathematics Division  
DIRECTORATE OF TECHNICAL SERVICES

Project 10522301A06102

February 1965

This publication or any portion thereof may not be reproduced without specific authorization from the Commanding Officer, U. S. Army Biological Laboratories, ATTN: Technical Releases Branch, Technical Information Division, Fort Detrick, Frederick, Maryland, 21701. However, DDC is authorized to reproduce the publication for U. S. Government purposes.

The information in this publication has been cleared for release to the public.

DDC AVAILABILITY NOTICE

Qualified requestors may obtain copies of this publication directly from DDC.

Foreign announcement and dissemination of this publication by DDC is limited.

ABSTRACT

An equation,

$$\frac{1}{\text{hours of dew}} = 0.2650 - \frac{12.26}{\text{temperature in degrees F}}$$

describing minimum conditions of temperature and dew period required for infection of rice leaves by Piricularia oryzae Cav. has been derived. Pairs of values from the curve describing the lower 95% confidence limit of the mean function are 60 F and 12.2 hours of dew, 65 F and 10.9 hours, 70 F and 9.7 hours, 75 F and 8.6 hours, and 80 F and 7.7 hours. It is suggested that infections at these values may be rare events in nature, and that the likelihood of infection increases as these values increase. Use of the equation's lower 95% confidence limit may improve the accuracy of existing blast disease forecasts.

# MINIMUM DEW PERIOD AND TEMPERATURE REQUIRED FOR INFECTION BY PIRICULARIA ORYZAE

An equation describing the minimum conditions of temperature and dew period required for infection of rice leaves by Piricularia oryzae Cav. has been derived from the published and unpublished data of Andersen,<sup>1</sup> Kahn<sup>2</sup> and others formerly of these laboratories. Generally speaking, their experiments involved holding inoculated plants at a selected temperature or narrow temperature range in a dew chamber<sup>3</sup> or other container with 100% relative humidity for a known length of time. In some series of tests, plants were held at a constant temperature and the length of dew period varied; in other series, dew period was the constant and plants were placed in chambers held at various temperatures. Races 1, 2, and 3 plus two isolates unidentified as to race of the fungus and the Caloro, Zenith, and Onsen varieties of rice were employed in their work.

Their data were reviewed and values of dew period and temperature at which the least number of lesions appeared were selected. Mrs. Jones then examined several mathematical expressions in an attempt to define a linear relationship between the two variables and simultaneously to fulfill a limiting requirement. She found a linear model describing minimum length of dew period as a function of temperature by taking reciprocals of both values:

$$\frac{1}{D} = a + \frac{b}{T}$$

where D = hours of dew and T = temperature in degrees F. Figure 1 shows this equation plotted together with observed values and lines indicating 95% confidence limits for the mean function.

Figure 2 shows the equation plotted in original units instead of reciprocals, the computed values of a and b (0.2650 and -12.26, respectively), and the 95% confidence limits for the mean function. As it stands, this

1. Andersen, A.L., B.W. Henry, and E.C. Tullis. 1947. Factors affecting infectivity, spread, and persistence of Piricularia oryzae Cav. Phytopathology 37:94-110.
2. Kahn, R.P., and J.L. Libby. 1958. The effect of environmental factors and plant age on the infection of rice by the blast fungus, Piricularia oryzae. Phytopathology 48:25-30.
3. Mitchell, J.E., and E. Cherry. 1954. A variable temperature incubation chamber permitting controlled deposition of dew. Phytopathology 44:498. (Abstr.)

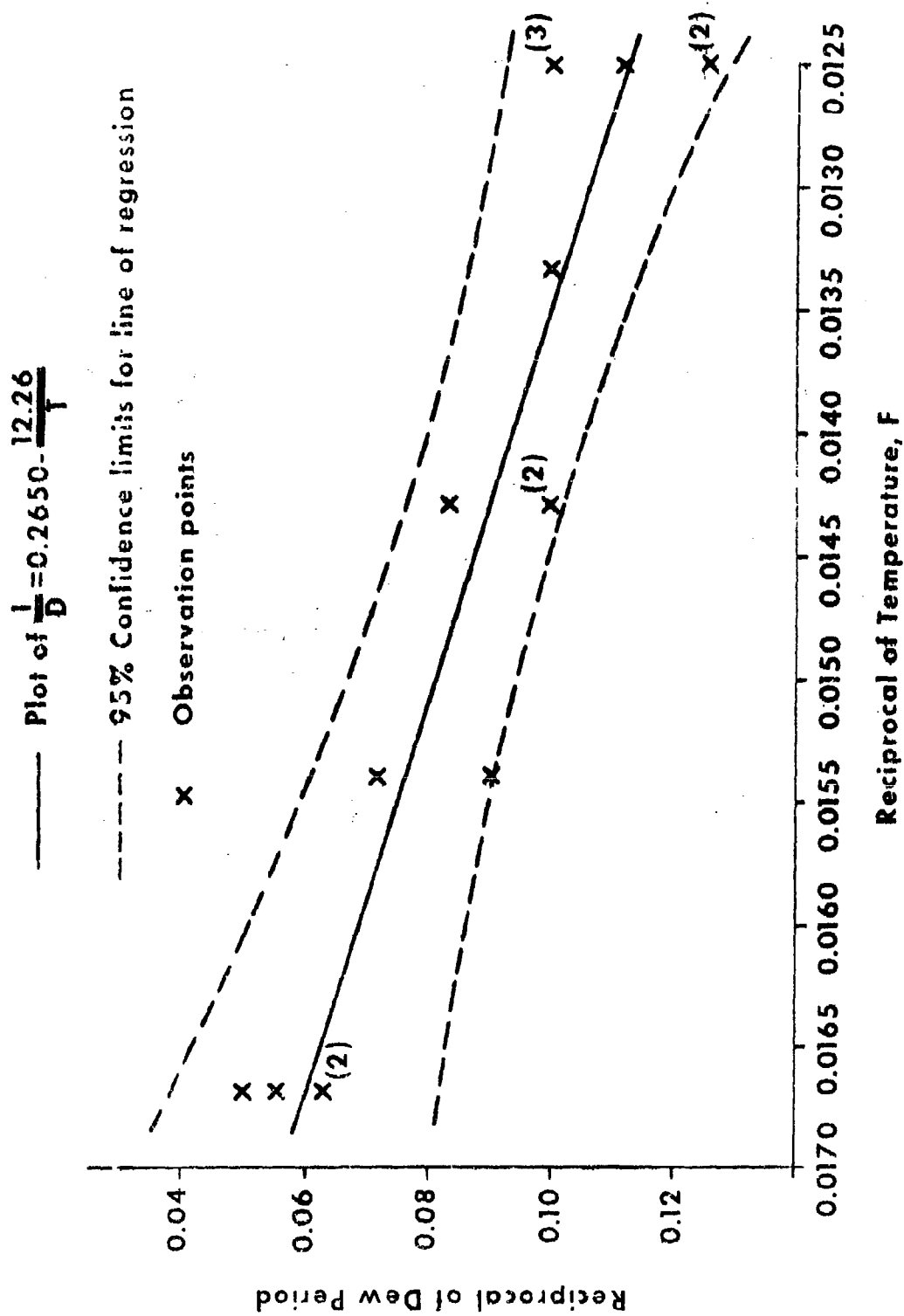


Figure 1. Minimum Dew Period Required for Infection as a Function of Temperature.



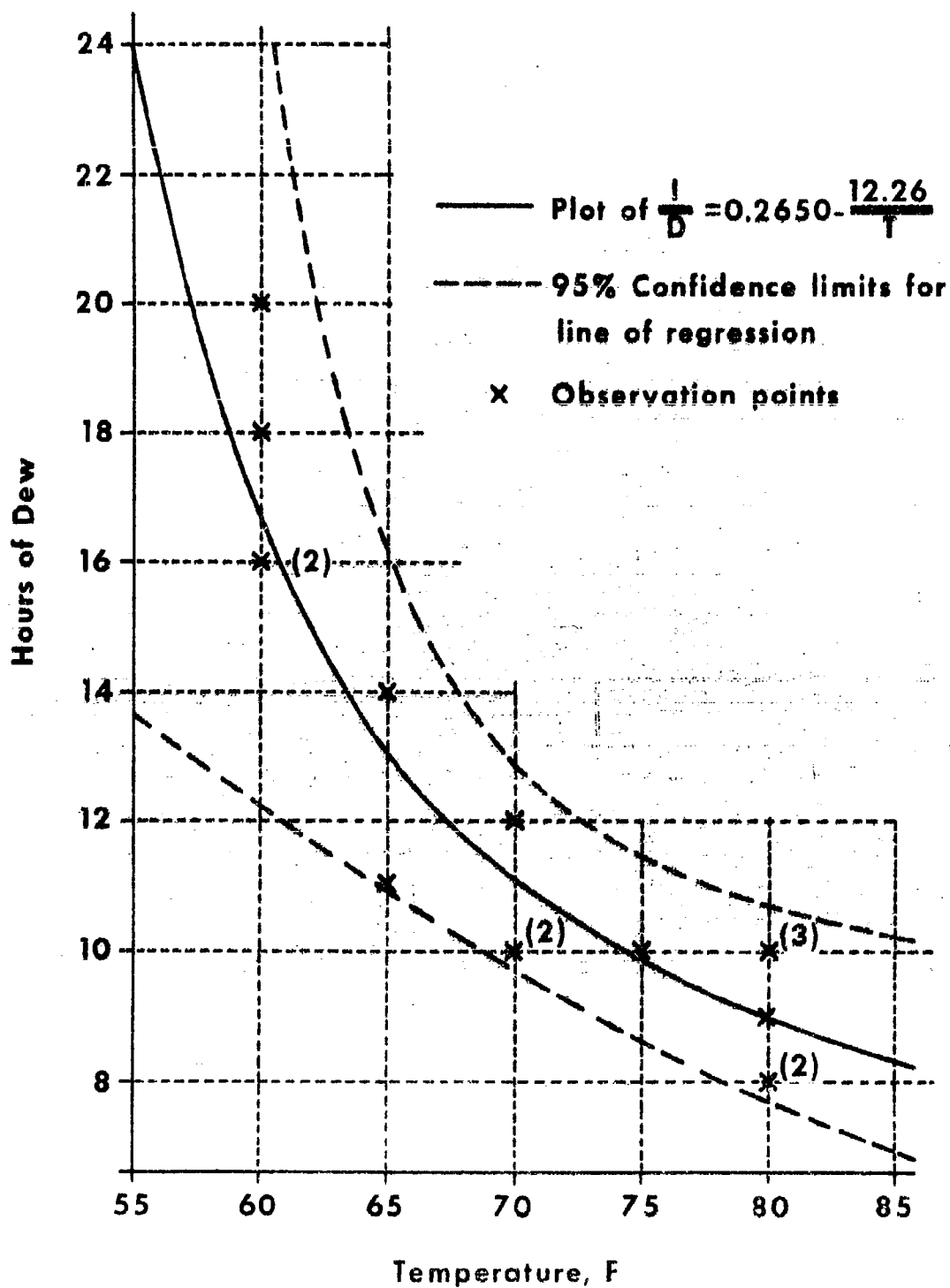


Figure 2. Minimum Dew Period Required for Infection as a Function of Temperature.

equation merely approaches a description of the minimum conditions required for infection, because an observer cannot see less than 1 lesion. There is always the possibility that if higher concentrations of inoculum had been used or if more leaf area had been inoculated, a lesion would have appeared at some lesser value of temperature or time; or that if closer intervals on the temperature or time scales had been used, an equation with narrower confidence limits might have been derived.

Computed asymptotes were 46.25 F for temperature and 3.78 hours of dew as the other variable becomes infinite. Of course, infinitely long dew periods or infinitely high temperatures do not occur in the natural environment of rice plants. These asymptotes, however, do indicate that infection will not occur unless related values of both variables rise above some limits.

In using the equation to determine whether a particular combination of dew period and temperature will permit infection when there is no other factor limiting, it may prove most useful to consider values that fall above the lower 95% confidence limit of the curve describing the mean function. Pairs of values from this lower limit are 60 F and 12.2 hours of dew, 65 F and 10.9 hours, 70 F and 9.7 hours, 75 F and 8.6 hours, and 80 F and 7.7 hours. Infections in nature may or may not prove to be rare events when these conditions occur. In either case, it is certain that at values somewhat greater than these, infections will be more numerous. Use of this equation, together with spore trapping and other presently employed forecasting practices, is expected to improve the accuracy of blast disease forecasts.

DISTRIBUTION LIST

<u>ADDRESSEE</u>	<u>NUMBER OF COPIES</u>
Assistant Scientific Director Building 812	1
Directorate of Biological Research Building 560	1
Chief, Crops Division Building 1301	10
Chief, Physical Sciences Division Building 568	1
Chief, Technical Evaluation Division Building 568	1
Documents, Technical Library Building 426	2
Test Chamber Branch Technical Evaluation Division Building 1412	1
Technical Releases Branch Technical Information Division Building 426	10
Liaison Representative/Animal Disease Investigations Building 1301	1
Public Health Service Liaison Office Building 1301	4
Commanding Officer U.S. Naval Unit Building 125	3
Commanding General U.S. Army Edgewood Arsenal ATTN: SMUEA-CS Edgewood Arsenal, Maryland, 21010	1
Commanding Officer U.S. Army Chemical Research & Development Laboratories ATTN: Librarian Edgewood Arsenal, Maryland	2

ADDRESSEENUMBER OF COPIES

Editorial Branch  
 Technical Information Division  
 Building 816

1

Commanding General  
 U.S. Army Munitions Command  
 ATTN: AMSMU-CS  
 Dover, New Jersey, 07801

1

Commanding General  
 U.S. Army Munitions Command  
 ATTN: AMSMU-RE-RR  
 Mr. G. Chesnov  
 Dover, New Jersey, 07801

1

Commandant  
 U.S. Army CBR Weapons Orientation Course  
 Dugway Proving Ground  
 Dugway, Utah, 84022

1

Commanding General  
 Deseret Test Center  
 ATTN: Technical Library  
 Fort Douglas, Utah, 84113

2

Commanding General  
 U.S. Army Materiel Command  
 Research Division, AMCRD-RC  
 R&D Directorate  
 Washington, D.C., 20315

1

Department of the Army  
 Asst Chief of Staff/Force Operations  
 ATTN: Technical Coordinator (B)  
 CBR & N Directorate  
 The Pentagon  
 Washington 25, D.C.

1

Defence Documentation Center  
 Cameron Station  
 Alexandria, Virginia, 22314

20

Detachment 4, RTD (ATCB)  
 Eglin Air Force Base, Florida, 32542

1

APGC (PGBAP-1)  
 Eglin Air Force Base, Florida, 32542

1

ADDRESSEENUMBER OF COPIES

Commandant  
USACmICan & Sch, ATTN: Bio Branch  
Ft. McClellan, Alabama, 36205

1

U.S. Army Standardization Group-Canada  
Office, Senior Standardization Rep.  
c/o Director of Equipment Policy  
Canadian Army Headquarters  
Ottawa 4, Canada

1

Munitions/TW  
Defence Research Staff  
British Embassy  
3100 Massachusetts Avenue, N.W.  
Washington 8, D.C.

3

Canadian Liaison Office (CRR)  
Building 5101  
Edgewood Arsenal, Maryland, 21010

3

Australian Embassy  
ATTN: Lt. Col. P. D. Yonge  
Australian Army Staff (W)  
2001 Connecticut Avenue, N.W.  
Washington 7, D.C.

2

Chief, Biomathematics Division  
Building 1422

1